

**EPA Superfund
Record of Decision:**

**PADUCAH GASEOUS DIFFUSION PLANT (USDOE)
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PADUCAH, KY
06/15/1995**

Record of Decision
for Interim Remedial Action
at the Northeast Plume,
Paducah Gaseous Diffusion Plant,
Paducah, Kentucky

June 1995

CERTIFICATION

Document Identification: Record of Decision for Interim Remedial Action at the
Northeast Plume, Paducah Gaseous Diffusion Plant,
Paducah, Kentucky DOE/OR/06-1356&D2

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this application and all attachments and that, based on my inquiry of those persons immediately responsible for obtaining the information contained in the application, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

U.S. Department of Energy
Owner and Operator

Jimmie C. Hodges, Paducah Site Manager
Paducah Site Office
U.S. Department of Energy

Date Signed

The Department of Energy has signed as "owner and operator" and Martin Marietta Energy Systems, Inc., has signed as "co-operator" this application for the permitted facility. The Department has determined that dual signatures best reflect the actual apportionment of responsibility under which the Department's RCRA responsibilities are for policy, programmatic, funding, and scheduling decisions, as well as general oversight, and the contractor's RCRA responsibilities are for day-to-day operations (in accordance with general directions given by the Department of Energy as part of its general oversight responsibility), including but not limited to, the following responsibilities: waste analyses and handling, monitoring, record keeping, reporting, and contingency planning. For purposes of the certification required by 40 CFR Section 270.11(d), the Department of Energy's representatives certify, to the best of their knowledge and belief, the truth accuracy and completeness of the application for their respective areas of responsibility.

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Martin Marietta Energy Systems, Inc.
Co-Operator

Martin Marietta Energy Systems, Inc

Date Signed

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Paducah, Kentucky

June 1995

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Prepared for
U.S. Department of Energy
Environmental Management and Enrichment Facilities

PREFACE

This Record of Decision for Interim Remedial Action at the Northeast Plume, Paducah Gaseous Diffusion Plant, Paducah, Kentucky (DOE/OR/06-1356&D2) was prepared in accordance with the requirements under both the Comprehensive Environmental Response, Compensation and Liability Act, the Resource Conservation and Recovery Act and Kentucky Revised Statutes 224.46. This work was performed under Work Breakdown Structure 1.4.12.7.1.02.05.03 (Activity Data Sheet 5302). Publication of this document follows the draft Federal Facility Agreement record of decision outline and meets a Primary Document Deliverable milestone for the Paducah Gaseous Diffusion Plant Environmental Management and Enrichment Facilities. This document provides the United States Department of Energy, the United States Environmental Protection Agency, and the Kentucky Department for Environmental Protection with a mechanism for documentation of a formal decision for selecting an interim remedial action to address the Northeast Plume.

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NOTATIONS

The following list of acronyms and abbreviations is provided to assist in the review of this document.

ACRONYMS AND ABBREVIATIONS

1,1-DCE	1,1-dichloroethene
99Tc	technetium-99
235U	uranium-235
238U	uranium-238
ACO	Administrative Order by Consent
ARAR	applicable or relevant and appropriate requirement
bgs	below ground surface
BMP	best management practices
C.F.R.	Code of Federal Regulations
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act of 1980
CWA	Clean Water Act
DNAPL	dense nonaqueous phase liquid
DOE	United States Department of Energy
EPA	United States Environmental Protection Agency
ESA	Endangered Species Act
Fed. Reg.	Federal Register
FWS	Fish and Wildlife Service
ft	foot (feet)
gal	gallon(s)
HAZMAT	hazardous materials training
HSP	health and safety plan
HSWA	Hazardous and Solid Waste Amendments of 1984
ICM	interim corrective measures
K.A.R.	Kentucky Administrative Regulations
K.R.S.	Kentucky Revised Statutes
KDEP	Kentucky Department for Environmental Protection
km	kilometer(s)
KPDES	Kentucky Pollutant Discharge Elimination System
l	liter(s)
l/sec	liters per second
m	meter(s)
MCL	maximum contaminant level
mg	milligram(s)
mi	mile(s)
MW	monitoring well
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NHPA	National Historic Preservation Act
NWP	nation wide permits
O&M	operation and maintenance
pCi/l	picoCuries per liter
PGDP	Paducah Gaseous Diffusion Plant
pH	hydrogen ion activity (inverse log)
PHEA	Draft Results of the Public Health and Ecological Assessment, Phase II
PRAP	proposed remedial action plan
RCRA	Resource Conservation and Recovery Act of 1976
RD	remedial design
RGA	Regional Gravel Aquifer
ROD	record of decision
SARA	Superfund Amendments and Reauthorization Act of 1986
SHPO	State Historic Preservation Officer
TBC	to be considered
TCE	trichloroethene

TVA	Tennessee Valley Authority
UCRS	Upper Continental Recharge System
UF6	uranium hexafluoride
U.S.C.	United States Code
U.S.C.A.	United States Code Annotated
USEC	United States Enrichment Corporation
VOC	volatile organic compound
: g/l	micrograms per liter

PART 1

DECLARATION FOR THE RECORD OF DECISION FOR INTERIM REMEDIAL ACTION AT THE NORTHEAST PLUME

SITE NAME AND LOCATION

Northeast Plume
Paducah Gaseous Diffusion Plant
Paducah, Kentucky

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected interim remedial action for the Northeast Plume at the Paducah Gaseous Diffusion Plant (PGDP) near Paducah, Kentucky, chosen in accordance with the Resource Conservation and Recovery Act of 1976 (RCRA), Kentucky Revised Statutes (K.R.S.), the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986, and the National Oil and Hazardous Substances Pollution Contingency Plan. This decision is based upon the administrative record for this site.

With the participation of the Kentucky Department for Environmental Protection (KDEP), both the United States Environmental Protection Agency (EPA) and the United States Department of Energy (DOE) entered into an Administrative Order by Consent (ACO) effective November 23, 1988, after the discovery of contamination in residential wells north of the PGDP. The ACO was drafted under Sections 104 and 106 of CERCLA. The DOE was issued a Kentucky Hazardous Waste Management Permit and an EPA Hazardous and Solid Waste Amendments Permit July 16, 1991. The KDEP portion of the RCRA permit was issued pursuant to Chapter 224 of the Kentucky Revised Statutes by authority granted from the EPA to the KDEP to administer a RCRA hazardous waste program. The EPA issued its portion of the RCRA permit pursuant to the Hazardous and Solid Waste Amendments of 1984. Hereinafter the two permits will be collectively referred to as the RCRA permits. The RCRA permits require the proper treatment, storage, and disposal of waste; corrective action (i.e., cleanup); closure of solid waste management units; and investigations of off-site contamination, including ground water contaminated by prior activities at the PGDP. On May 31, 1994, the PGDP was placed on the National Priorities List (effective date June 30, 1994). The DOE is currently negotiating a Federal Facilities Agreement with the EPA and the KDEP.

On July 2, 1993, the DOE was directed by the KDEP and the EPA to submit a workplan to implement an interim measure at the Northeast Plume. This interim remedial action will be initiated pursuant to the Interim Measure Provisions of PGDP's Kentucky Hazardous Waste Permit issued by the KDEP, the Hazardous and Solid Waste Amendments Permit issued by the EPA, and this record of decision (ROD). The Kentucky Division of Waste Management concurs with the DOE and the EPA on the selected interim action, in accordance with the requirements of the Kentucky Hazardous Waste Management Permit. The scope of this action warrants the incorporation of the selected remedy into Kentucky's Hazardous Waste Permit. This ROD will serve as the primary document for the modification to Kentucky's Hazardous Waste Permit. This action will serve as a step toward comprehensively addressing the Northeast Plume.

In January 1994, the Interim Corrective Measures Workplan for the Northeast Plume was submitted to the EPA and the Commonwealth of Kentucky. The workplan described the investigation and provided the path forward for an interim remedial action or a final remedial action for the contaminated ground water emanating from the northeast part of the PGDP. However, information derived from the Groundwater Monitoring Phase IV Investigation indicated the need to modify the workplan schedule. The rationale for this modification includes: the discovery of multiple plumes and sources composing the Northeast Plume including one area of acute trichloroethene (TCE) ground water contamination that emanates from the eastern margin of the plant and extends off DOE property; a better definition of the plume's boundaries; and the long-term goal to develop an efficient and cost-effective ground water strategy. Following an October 5, 1994, meeting between the DOE, the EPA, and the Commonwealth of Kentucky, the decision was made to

proceed with an interim remedial action for the high TCE concentration ground water plume.

This action will retard the migration of the highest TCE concentration area within the ground water plume emanating from the eastern margin of the PGDP. Ground water will be extracted from at least one well located along Ogden Landing Road and pumped through a pipeline to a treatment facility. The extraction well(s), pipeline, and the treatment facility will be located on DOE property. Contaminated ground water will be pumped at a rate, based on current ground water modeling, adequate to initiate hydraulic control of the high TCE concentration plume which extends northeast of the plant security fence. In addition, the extraction rate may be optimized in order to minimize the movement of technetium-99 and other areas of acute TCE contamination detected near the plant's eastern boundary. Concurrent with the interim remedial action in Alternative 2 is a provision for two treatability studies which examine the following innovative technologies: (1) photocatalytic oxidation of TCE, and (2) in situ treatment of TCE-contaminated ground water.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances and constituents from the site, if not addressed by implementing the response action selected in this ROD for interim action, may present an imminent and substantial endangerment to public health, welfare, or the environment in the future.

DESCRIPTION OF SELECTED REMEDY

The primary objective of this interim remedial action is to implement a first-phase remedial action as an interim action to initiate hydraulic control of the high concentration area within the Northeast Plume that extends outside the plant security fence. Because ground water serves as a pathway for contamination to move to the surrounding area, it has received the highest priority for undergoing prompt interim actions. The ground water at the PGDP will be addressed comprehensively in an operable unit (hereinafter defined as the "Ground Water Integrator Operable Unit"). The Northeast Plume is one part of the Ground Water Integrator Operable Unit. Final remedial decisions for the Northeast Plume and the Ground Water Integrator Operable Unit will be made through the remedial investigation and remedy selection process, after the nature and extent of contamination in the ground water system(s) and the areas (i.e., source operable units) contributing contaminants to the ground water are more fully understood.

The major components of the interim action remedy include:

- The contaminated ground water will be extracted at a location in the northern portion of the high TCE concentration area of the plume (greater than 1,000 micrograms per liter of TCE). The contaminated ground water will be pumped at a rate of approximately 100 gallons per minute to initiate hydraulic control without changing ground water gradients enough to cause adverse effects. During operation, this pumping rate may be modified to optimize hydraulic containment, by adjusting flow from the extraction wells, and to support subsequent actions.
- The extracted ground water will be collected and piped to a treatment system prior to release to a Kentucky Pollutant Discharge Elimination System permitted outfall. The treatment facility will consist of a sand filter for removal of suspended solid materials, and utilization of the PGDP's existing cooling towers for volatilization of contaminated ground water. The chemicals of concern are TCE and 1,1-dichloroethene.
- Two treatability studies which include: (1) photocatalytic oxidation of TCE-contaminated off-gas, and (2) in situ treatment of TCE-contaminated ground water.

The KDEP and the EPA have participated in the development of this ROD, including review and comment on the content of the document. All KDEP and EPA comments issued to DOE have been incorporated into the ROD.

STATUTORY DETERMINATIONS

This interim action is protective of human health and the environment, complies with federal and state applicable or relevant and appropriate requirements for the scope of this limited action, is cost effective and is consistent with RCRA requirements. Although this interim action is not intended to fully address the statutory mandate for permanence and treatment to the maximum extent practicable, this interim action does utilize treatment and, thus, is in furtherance of that statutory mandate. Subsequent actions are planned to address the principal threats posed by the conditions at this site. Because this remedy will result in hazardous substances and constituents remaining onsite above health-based levels, a review will be conducted within five years after commencement of the remedial action, and every five years thereafter, until a final remedial alternative is selected and implemented. These reviews will be conducted to ensure that the selected remedy continues to provide adequate protection of human health and the environment. Because this is an interim action ROD, review of this operable unit and of this remedy will be ongoing as the DOE continues to develop final remedial alternatives for the Ground Water Integrator Operable Unit.

Robert Dale Dempsey
Assistant Manager for Environmental Management
United States Department Of Energy

Date_____

John H. Hankinson, Jr.
Regional Administrator
United States Environmental Protection Agency, Region IV

Date_____

PART 2

DECISION SUMMARY

2.1 Site Name, Location, and Description

The Paducah Gaseous Diffusion Plant (PGDP), located in western Kentucky, is an active uranium enrichment facility owned by the United States Department of Energy (DOE). Effective July 1, 1993, the DOE leased the plant's production facilities to the United States Enrichment Corporation (USEC) which in turn contracted with Martin Marietta Utility Services, Inc., to provide operation and maintenance services. Lockheed Martin Energy Systems, Inc., manages the environmental restoration and waste management activities for the DOE at the PGDP.

The PGDP is situated on a 1,457 hectare (3,600 acre) reservation approximately 6.4 kilometers (km) [4 miles (mi)] south of the Ohio River and about 16 km (10 mi) west of Paducah, Kentucky (Figure 1). About 304 hectares (750 acres) of the reservation are within a security area and buffer zone that have restricted access to the general public. Beyond the DOE-owned buffer zone is the Western Kentucky Wildlife Management Area which covers approximately 2,428 hectares (6,000 acres).

2.2 Site History and Enforcement Activities

Construction of the PGDP began in 1951, and operations began in 1952. The PGDP uses gaseous diffusion to provide a physical separation process which allows for enrichment of the uranium. Commercially produced uranium hexafluoride (UF₆) is composed primarily of uranium-238 (238U), and a small percentage of uranium-235 (235U). The gaseous diffusion process is premised on the fact that UF₆ with fissionable 235U is slightly lighter than UF₆ with 238U. Therefore, as the UF₆ passes through the gaseous diffusion plant's cascade system, separation of 235U from 238U takes place. This separation results in enriched uranium (increased percentage of 235U). This enriched uranium is then transported to USEC's enrichment facility in Piketon, Ohio, for further enrichment.

The DOE is conducting cleanup activities at the PGDP. These cleanup efforts are necessary to address contamination that has resulted from past operations at the plant. Remedial activities are being conducted in consultation with the Kentucky Department for Environmental Protection's (KDEP's) Division of Waste Management, the Radiation Control Branch, and the United States Environmental Protection Agency (EPA).

In August 1988, volatile organic compounds (VOCs) and radionuclides were detected in ground water from residential wells north of the PGDP. In response to this discovery, the DOE and the EPA entered into an Administrative Order by Consent (ACO) under Sections 104 and 106 of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA) (i.e., conduct a remedial investigation/feasibility study). The DOE then implemented the PGDP Water Policy to reduce the current risk to potential human exposure (i.e., potentially affected residence and businesses).

The CERCLA site investigations discovered trichloroethene (TCE)-contaminated ground water within the Regional Gravel Aquifer (RGA) northeast of the plant. This plume is referred to as the Northeast Plume. The DOE submitted an interim corrective measures (ICM) workplan for the Northeast Plume to the EPA and the Commonwealth of Kentucky in order to conduct an investigation and provide the path forward for an interim remedial action as required by the Hazardous Waste Permit or a final remedial action for the contaminated ground water emanating from the northeast part of the PGDP.

Results of the Groundwater Monitoring Phase IV Investigation, published in the Northeast Plume Preliminary Characterization Summary Report, delineated numerous plumes in the RGA that coalesce to form the Northeast Plume. One of these plumes is a zone of high TCE concentration [TCE concentrations exceeding 1,000 micrograms per liter (:g/l)] that emanates from the eastern

margin of the plant and extends off DOE property (Figure 2). No technetium-99 (99Tc) contaminated ground water occurs above the current calculated MCL of 900 pCi/l within the portions of this plume that occur outside the PGDP fence. Because this TCE plume is migrating northeast toward the eastern boundary of the area served by the PGDP Water Policy, a potential risk exists; therefore, this interim remedial action is necessary.

One source of ground water contamination in the Northeast Plume is thought to be the Kellogg Building leach field (Figure 3). The Groundwater Monitoring Phase IV Investigation results indicate that this leach field may have been a significant contributor to the zone of highest TCE-contaminated ground water emanating from the eastern margin of the PGDP. Site investigations suggest the presence of free-phase TCE, a dense nonaqueous phase liquid (DNAPL) in the subsurface material at the PGDP which represents additional sources of ground water contamination.

2.3 Highlights of Community Participation

On March 12 and 13, 1995, a notice of availability was published in The Paducah Sun, a regional newspaper, regarding the Proposed Remedial Action Plan for Interim Remedial Action at the Northeast Plume. The Proposed Remedial Action Plan (PRAP) was released to the public March 12, 1995. The PRAP was made available for public review at the Paducah Public Library and the off-site Environmental Information Center located in the West Kentucky Technology Park in Kevil, Kentucky. A public comment period was held March 12 through April 25, 1995.

Specific groups that received individual copies of the PRAP included the local PGDP Neighborhood Council, Natural Resource Trustees, and the PGDP Environmental Advisory Committee. An informal meeting was held with the PGDP Environmental Advisory Committee on March 2, 1995. At this meeting, DOE personnel briefed the Committee on the proposed action and solicited both written and verbal comments.

Phone calls and/or visits were made to various stakeholders, including neighbors and representatives of environmental groups, to advise them of the public comment period and briefly explain the PRAP. The PRAPs were mailed to those contacted. A response to the comments received during the public participation period is included in the Responsiveness Summary, which is part of this record of decision (ROD).

The PRAP contained a notice of the availability for a public meeting to discuss the Northeast Plume and proposed actions. However, no requests for a public meeting were received.

This decision document presents the selected interim remedial action for the Northeast Plume at the PGDP, chosen in accordance with CERCLA, as amended by the Superfund Amendments and Reauthorization Acts of 1986 (SARA), the EPA and Commonwealth of Kentucky permits issued under the Resource Conservation and Recovery Act (RCRA), as amended by the Hazardous and Solid Waste Amendments of 1984 (HSWA), Kentucky Revised Statute (K.R.S.) 224.46, and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). The decision for interim remedial action at this site is based upon administrative record documentation.

2.4 Scope and Role of Operable Unit

Response Action and the Site Management Strategy

The PGDP presents unusually complex problems in terms of hazardous waste management and environmental releases. The DOE's proposed strategy is to divide the site into operable units grouped by source areas and Ground Water Integrator Operable Units. Discrete response actions will be selected and implemented for each operable unit to address the source areas (i.e., source operable units) and the integrator operable units impacted by commingled releases from source operable units. Prioritization for investigation and possible interim remedial actions has been assigned to each of the integrator operable units and source operable units depending

on their potential for contributing to off-site contamination. Because ground water integrator units serve as migration pathways that transport contamination from source operable units to off-site receptors, they receive the highest priority for undergoing initial evaluation and interim remedial actions.

Consistent with the DOE's strategy, this action is intended as an incremental step toward addressing the Ground Water Integrator Operable Unit. The Northeast Plume contributes to off-site ground water contamination that will continue to migrate and may contaminate clean resources and potentially expose additional off-site receptors. Implementation of this interim remedial action will: (1) initiate hydraulic control of the high concentration area of TCE contamination within the Northeast Plume that is migrating outside the eastern margin of the plant security fence, and (2) Monitor the performance of this interim remedial action in order to track contaminant migration and assess the system's performance prior to development of a final remedy.

This action can be implemented to monitor the performance of this interim remedial action in order to track contaminant migration, and assess the system's performance prior to development of the final remedy. Remedial investigations can continue to be conducted for the remainder of the Northeast Plume and Ground Water Integrator Operable Unit. This phased approach is consistent with EPA regulations and guidance and in accordance with the Hazardous Waste Permit, which advises initiation of early actions as soon as possible after a problem is identified for which an early action is appropriate, and early actions should be coordinated with final remedies such that they are the first phase of the overall remedial action.

Future Response Actions Associated with this Response Action

The remedial action described by this ROD is not the final action for the Northeast Plume. Following issuance of the ROD for this interim measure, additional remedial investigations and/or treatability studies will be initiated to obtain data needed for evaluating remedial alternatives to implement a final remedy which will provide protection of human health and the environment. These remedial investigations and/or treatability studies will be consistent with the requirements of both the draft Site Management Plan and the draft Federal Facility Agreement being developed by the DOE, the EPA, and the KDEP. This study may lead to a PRAP for a second interim remedial action and/or a final action for the Northeast Plume.

Although a site investigation, public health and ecological assessment, and an alternative evaluation were performed for the PGDP site as a whole, a final action cannot be recommended until further characterization activities have been completed. Before a final action can be recommended for the northeast portion of the Ground Water Integrator Operable Unit, a baseline risk assessment must be completed, including an ecological risk assessment. Additionally, a more complete characterization of the Northeast Plume needs to be performed and the interaction of all source operable units with the Ground Water Integrator Operable Unit must be better defined. Although additional data will be needed before the selection of a final action, sufficient information is available to support recommendation of the interim remedial action presented in this document. This interim remedial action should not be inconsistent with nor preclude implementation of any currently anticipated final remedy.

2.5 Summary of Site Characteristics

Hydrogeologic Characteristics

The subsurface geologic framework at the PGDP consists of Mississippian limestone bedrock overlain by 105 meters (m) [344 feet (ft)] of unconsolidated sediments. Figure 4 presents a schematic cross section illustrating the conceptual geology at the site. The following discussion focuses on the lithologies present in the area encompassing the Northeast Plume.

The surficial deposits northeast of the plant consist of a 1.5 to 7.6 m (5 to 25 ft) thick clayey silt of wind-blown origin called loess and alluvial flood deposits of sand and silt which occur within the floodplain of Little Bayou Creek. The soils that formed in the upper 1.2 m (4 ft) of the loess and alluvial deposits are silt loams of the Calloway, Grenada, Henry, Loring,

and Vicksburg Soil Series.

Underlying the surficial deposits to a depth ranging from 21 to 36 m (75 to 118 ft) below ground surface (bgs) are the continental deposits of late Tertiary and Quaternary age. These unconsolidated deposits, composed of an upward-fining sequence of gravels, sands, silts, and clays, are divided into an upper and lower member. The upper continental deposits consist of sand, silt, and clay with occasional discontinuous gravel lenses that range in thickness from 6 to 18 m (20 to 59 ft). The coarser textured, more permeable lenses within the upper continental deposits have been informally grouped into a ground water flow system referred to as the Upper Continental Recharge System (UCRS). Ground water is found in the UCRS on both a perennial and a seasonal basis. The ground water flow direction in the UCRS is ultimately downward into the underlying aquifers.

The lower continental deposits consist of chert gravel and sand deposited in a high energy, fluvial environment. Averaging 9 m (30 ft) thick, the deposits pinch out to the south against a buried escarpment called the Porters Creek terrace (Figure 4). The base of the deposits is an undulating, erosional surface created by scouring into the underlying Porters Creek Clay and McNairy Formation. These channels were subsequently filled with a complex sequence of gravel and sand. Discrete, elongate, coarser grained, clean gravel units occur within the lower continental deposits forming high permeability zones. One such unit, less than 305 m (1,000 ft) wide, extends about 1.6 km (1 mi) northeast of the plant along the southernmost edge of the Northeast Plume.

Lithologies composing the lower continental deposits form a hydrogeologic unit informally called the RGA. The RGA is the dominant ground water flow system in the area due to its relatively high hydraulic conductivity and is the primary aquifer of interest in this interim remedial action. Ground water recharge is by downward percolation through the UCRS and via underflow through gravels located south of the Porters Creek terrace. From the site, ground water flows northward toward the Ohio River, which is the local base level for the system.

Discrete high permeability gravel units in the RGA, such as the one identified along the southern edge of the Northeast Plume, may provide local pathways for ground water and contaminant flow. The orientation of these pathways may help to explain the current geometry of the Northeast Plume, because the interpreted trend of contaminant migration contradicts the direction of apparent ground water movement derived from potentiometric contours.

The lower continental deposits are directly underlain by the Porters Creek Clay and the McNairy Formation at a depth ranging from 21 to 36 m (75 to 118 ft) bgs. The Porters Creek Clay is a homogeneous clay that forms the buried terrace face along the southern edge of the PGDP. South of the Porters Creek terrace, the Porters Creek Clay averages 26 m (85 ft) thick, and north of the terrace the clay ranges from 0 to 6 m (0 to 20 ft). This clay is generally a low permeability barrier to ground water flow.

Interbedded and interfingering clay, silt, and fine sands, with some lignite and pyrite, compose the Cretaceous McNairy Formation. This formation averages 68 m (223 ft) in thickness in the Northeast Plume area. The McNairy Flow System is a hydrogeologic unit that refers to the water-bearing sands within the McNairy Formation. Ground water within the McNairy Flow System moves in a northerly direction toward discharge areas along the Ohio River. Although the hydraulic conductivity of the McNairy sands is several orders of magnitude less than that of the RGA gravels, there is a vertical hydraulic connection between the two where they are in contact.

Directly underlying the McNairy Formation are the Cretaceous Tuscaloosa Formation and the Mississippian rubble zone which together consist of rounded to subangular chert and silicified limestone fragments up to 6 m (20 ft) thick (Figure 4). Bedrock beneath the site occurs at approximately 105 m (344 ft) bgs.

A three-dimensional ground water flow model was developed in July 1994 to simulate the regional ground water flow in the vicinity of the PGDP. The DOE selected the MODFLOW computer code, a

publicly available ground water flow simulation program developed by the United States Geological Survey. In order to simulate ground water flow in the principal water-bearing units beneath the site on a regional scale, the flow model was constructed and calibrated to cover nearly 100 km² (39 mi²). The regional model simulates ground water flow in multiple water-bearing units consisting of the UCRS, RGA, and the McNairy Flow System. A detailed presentation of the computer model is presented in the Technical Memorandum for Interim remedial Action of the Northeast Plume at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky (DOE/OR/06-1318&D2)

Operable Unit Characteristics

The Kellogg Building leach field may have been a significant source for the high concentration zone of ground water contamination emanating from the eastern margin of the PGDP along the southern edge of the Northeast Plume. Located adjacent to the plant's eastern security fence line (Figure 3), the former Kellogg Building functioned as a pipe fabrication facility during the initial construction of the plant's cascade system. It is believed that TCE may have been used extensively at this facility from 1951 to 1955 when the building was demolished. Drains in the former Kellogg Building are thought to have emptied into a leach field southeast of the building. The Ground Water Monitoring Phase IV Investigation discovered elevated concentrations of TCE in the ground water in the vicinity of this leach field. As a result, the Kellogg Building leach field is considered a potential source of TCE ground water contamination for the Northeast Plume.

Additional source units likely contribute to the high concentration zone of ground water contamination emanating from the eastern margin of the PGDP along the southern edge of the Northeast Plume. These sources are probably located inside the plant's security fence to the southwest of the Kellogg Building leach field nearer to the origin of the high concentration zone of TCE contamination shown on Figure 2. Identification and further characterization of the significant source units contributing to this plume is necessary before a final remedial action is taken.

Contaminant Characteristics

The contaminants of concern in the Northeast Plume outside the plant security fence are TCE and 1,1-dichloroethene (1,1-DCE). Trichloroethene is the predominant contaminant in the Northeast Plume. The Groundwater Monitoring Phase IV Investigation measured TCE concentrations in ground water extracted from soil borings located outside the plant security fence up to 2,856 :g/l, which exceeds the maximum contaminant level (MCL) of 5 :g/l. A degradation product of TCE, 1,1-DCE, was detected above the MCL of 7 :g/l in the ground water sampled from two soil borings, D-9 and D-10, located immediately east of the PGDP fence (Figure 2). The maximum concentration of 1,1-DCE measured was 15 :g/l.

Trichloroethene is a halogenated organic chemical used widely as a metal degreaser. Although TCE is no longer used at the PGDP, past use and disposal practices resulted in soil and ground water contamination. At the PGDP, the two major forms of TCE contamination in the subsurface are: (1) dissolved phase in the ground water; and (2) free-phase product. Because it is relatively insoluble at high concentrations and has a higher specific gravity than water, free-phase TCE is a DNAPL. When spilled, free-phase TCE moves downward through the unsaturated zone and the aquifer under the influence of gravity. Lateral spreading occurs as the free-phase TCE seeks out lower capillary pressure, higher permeability pathways through heterogeneous subsurface material. This DNAPL movement ceases when the volume of free product is insufficient to overcome the capillary pressure of the subsurface material. Free-phase TCE, distributed as residual blobs and ganglia, dissolves slowly into the ground water causing continued contamination of the downgradient aquifer.

The radionuclide ⁹⁹Tc was introduced to the PGDP as a by-product of the reprocessing of uranium. This radionuclide was probably introduced into the ground water from past handling or disposal of TCE contaminated with ⁹⁹Tc and scrap metal contaminated with ⁹⁹Tc. Ground water sampled from the RGA in four soil borings located immediately east of the plant security fence detected ⁹⁹Tc contamination at concentrations up to 58 pCi/l. The extent of this ⁹⁹Tc contamination is shown

on Figure 2 by the 30 pCi/l isopleth, which represents the lowest concentration for which a coherent plume boundary can be drawn. The 58 pCi/l 99Tc concentration is low with respect to the aqueous regulatory concentration of 900 pCi/l currently calculated from the MCL of 4 millirems per year. Since 99Tc is a weak beta emitter, it has been classified by the EPA as a Group A carcinogen (known human carcinogen).

Trichloroethene ground water contamination in the Northeast Plume outside the PGDP security fence occurs primarily within the RGA. Isolated instances of TCE ground water contamination occur in the McNairy Formation as well. Ground water in the RGA is contaminated in a plume complex approximately 1.2 km (0.75 mi) wide that extends about 2.4 km (1.5 mi) to the northeast of the plant (Figure 2). A narrow zone of high TCE contamination, defined by the 1,000 :g/l isopleth, occurs within the southernmost portion of the plume complex. This high concentration zone originates within the plant, emanates from the plant's eastern boundary in the vicinity of the Kellogg Building leach field, and extends at least 1.6 km (1 mi) to the northeast, north of Ogden Landing Road (Figure 2).

Both the distribution and internal stratigraphy of the RGA influence the distribution of TCE contamination. The southeastern margin of the Northeast Plume is controlled by the pinchout of the RGA against the Porters Creek terrace. The geometry of the high TCE concentration zone corresponds to the trend of the coarser-grained, well-sorted gravel unit located along the southern edge of the Northeast Plume. This gravel unit may provide a preferred pathway for contaminant migration. The vertical distribution of TCE within the high concentration zone varies with distance from probable source areas. Trichloroethene concentrations increase toward the bottom of the aquifer as the distance from source areas increases. In the vicinity of suspected source areas, such as the Kellogg Building leach field, contamination is distributed more equally throughout the RGA.

The Groundwater Monitoring Phase IV Investigation discovered TCE-contaminated ground water within sands of the upper part of the McNairy Formation. The frequency and concentration of TCE decreases to the northeast of the plant. The highest concentration reported from the McNairy Formation outside the plant security fence was 413 :g/l from soil boring D 10 (Figure 2). The sand is laterally discontinuous, pinching out 15.3 (50 ft) and 7.6 m (25 ft) to the east and west, respectively, of soil boring D 10.

2.6 Summary of Site Risks

Based on the results of investigative activities at the Northeast Plume, the DOE, the EPA, and the KDEP have decided that there is sufficient potential risk to the public and environment to warrant this action. The principal goal of this interim remedial action is to implement control measures which will mitigate migration of the contaminants.

Long-term exposure to TCE via ingestion or inhalation have produced increases in liver, lung, and kidney tumors in mice and rats. Therefore, the EPA has classified TCE as a B2 carcinogen (probable human carcinogen). This classification is currently being reviewed by the EPA.

A breakdown product of TCE is 1,1-DCE. The liver is the principal target organ of 1,1-DCE toxicity. The EPA classifies 1,1-DCE as a Class C carcinogen (possible human carcinogen).

Infiltration and downward migration of TCE may lead to ground water contamination with ground water flow as the transport mechanism to off-site locations. The primary routes of exposure include ingestion of contaminated ground water and dermal absorption and inhalation through domestic uses of contaminated ground water. Other exposure pathways, although less likely, include release of contaminated ground water into surface water and sediment with subsequent incidental ingestion and dermal absorption. Current data indicates that the Northeast Plume has not contaminated a surface water body. Notwithstanding, this exposure pathway is less certain, as significant dilution in surface water and loss of both TCE and 1,1-DCE due to volatilization may result in concentrations in surface water and sediment that are of no toxicological concern.

Risks associated with the off-site ground water have been reduced greatly by the Paducah Gaseous Diffusion Plant Water Policy. The purpose of the Water Policy is to eliminate exposure by

restricting ground water use. Since municipal water is provided to affected and potentially affected residences and businesses, there are currently no significant risks to human health. If, in the future, the present water policy is no longer in effect and institutional controls are ignored, area residents could be at risk from exposure to contaminated ground water. Potential future exposures for an off-site resident include ingestion of contaminated drinking water and inhalation of volatile organic compounds during household water use.

The ACO states that monthly sampling of residential wells is required for those wells potentially affected by the contaminant plume. In accordance with the ACO under Sections 104 and 106 of CERCLA, residential wells are sampled on a routine basis for pH, temperature, turbidity, TCE, 99Tc, and gross alpha and beta activities. The ACO will not cover future off-site residents.

2.7 Description of Alternatives

The screening and evaluation process identified one remedial alternative that will quickly and effectively reduce risk by retarding the migration of contamination from the Northeast Plume.

Alternative 1 - No Action

Pursuant to 40 C.F.R. § 300.430(e)(6), the DOE is required to consider a no action alternative. This alternative is useful as a baseline for comparison between potential alternatives. Under this alternative, no further action would be taken with regard to the Northeast Plume.

Alternative 2 - Hydraulic Plume Control

The hydraulic plume control interim remedial action consists of one or more extraction well(s) to be placed near the north end of the high concentration area of the Northeast Plume located near Ogden Landing Road. This action will initiate hydraulic control of the high concentration area of the Northeast Plume and mitigate the concentrations of TCE in the ground water. The wells are expected to be located on DOE property (Figure 5) within the high TCE concentration isopleth of the plume. Extracted ground water will be pumped through a pipeline at approximately 6.3 liters per second (l/sec) (100 gallons per minute) to a water treatment facility. The treatment facility will consist of a sand filter for removal of suspended solid materials, and utilization of the PGDP's existing cooling towers for volatilization of TCE-contaminated ground water (Figure 6). The sand filter may be located near the PGDP's eastern security fence. The cooling tower is located on DOE property within the security fence (Figure 5). The pipeline will be placed under existing gravel roads or within created ditches immediately adjacent to these roads. Treated water will be discharged to a Kentucky Pollutant Discharge Elimination System (KPDES) permitted outfall along the western boundary of the PGDP.

Data gathered during the Northeast Plume investigations and operations will be used to optimize the remedial action by adjusting flow rates from the extraction well(s) to control the plume to the maximum extent possible while minimizing adverse effects. Hydraulic plume control is consistent with the EPA's Office of Solid Waste and Emergency Response Directive 9283.1-03 and the Hazardous Waste Permit which sets a policy for remediation of aqueous contaminant plumes. The directive advises that the plume should be contained early, that initiation of early actions should take place as soon as possible after a problem is identified for which an early action is appropriate, and that early actions should be coordinated with final remedies such that they are the first phase of the overall remedial action. The directive further advises that remedial actions for contaminated ground water should be implemented in a phased approach.

Two innovative pilot-plant studies will be conducted during this interim remedial action. The studies will evaluate technology performance and cost effectiveness for potential full-scale implementation. The two innovative pilot-treatment studies are:

- (1) Photocatalytic oxidation treatment of off-gas; and
- (2) In situ treatment of TCE-contaminated ground water.

Photocatalytic oxidation treatment of off-gas is an innovative technology (Figure 7). Reduction of TCE by this technology has been demonstrated, but is unproved at the PGDP. Site-specific information is required in order to determine an appropriate cost estimate and design criteria of equipment for a future full-scale operation. A small side stream volume will be varied in order to conduct the pilot study, thus testing the photocatalytic oxidation performance. A three-month pilot demonstration is expected. Benefits of this technology include the following:

- Complete destruction of VOCs before discharge of off-gas;
- Low operation and maintenance (O&M) cost; and
- Compatible with in situ treatment technologies.

The in situ ground water treatment well is also an innovative treatment technology. This technology is appropriate for demonstration at the PGDP (Figure 8). If successful, this technology has several potential benefits, including:

- Reduction of waste generated during the remedial action;
- No contaminated water transfer to the surface; therefore, no treatment cost, disposal, or associated permits are required;
- Less intrusive in environmentally sensitive areas within the PGDP where logistics limit remedial alternatives;
- No regional lowering of the ground water level, thus reducing the effect on the regional flow system;
- The entire thickness of the aquifer may be included in circulation (radius of influence); and
- Lower cost than conventional pump and treat technology.

One in situ ground water treatment well is proposed for this two-year pilot study. If this technology is determined viable for operation, wells located across the high concentration portion of the plume can remediate contaminants which migrate to the wells, or the wells can be located near source area(s) for mass reduction. Other objectives include determining if the technology reduces TCE concentrations in ground water below remedial goal objectives or MCLs, estimates of the radius of influence of the treatment system, operating cost associated with the technology, and the time for remediation to acceptable levels to occur. A secondary objective would be to couple this technology with photocatalytic oxidation as the off-gas treatment, since photocatalytic oxidation could provide complete destruction of off-gas from the well. Additional secondary objectives include: documentation of selected aquifer characteristics that may be affected by oxygenation and recirculation of treated ground water; documentation of off-gas concentrations from the well bore; and documentation of other operating parameters as needed in the design phase.

2.8 Summary of the Comparative Analysis of the Interim Alternative

This section provides the basis for determining which alternative (1) meets the threshold criteria of overall protection of human health and the environment, and complies with applicable or relevant and appropriate requirements (ARARs) and is consistent with the Hazardous Waste Permit; (2) provides the best balance between effectiveness and reduction of toxicity, mobility, or volume through treatment, implementability, and cost; and (3) satisfies state and community

acceptance criteria. Because of the limited scope of this interim remedial action, the comparative analysis focuses on the selected remedy, while considering the No Action Alternative under the appropriate criteria.

CERCLA requires nine criteria be used for evaluating the expected performance of remedial actions. The nine criteria are identified below and the interim remedial action has been evaluated on the basis of these criteria.

1. Overall protection of human health and the environment. This requires that the alternative adequately protect human health and the environment, in both the short- and long-term. Protection must be demonstrated by the elimination, reduction, or control of unacceptable risks. The EPA's goal is to return usable ground water to its beneficial use within a time frame that is reasonable given the particular circumstances of the site.
2. Compliance with ARARs. The alternatives must be assessed to determine if they attain compliance with ARARs of both state and federal law.
3. Long-term effectiveness and permanence. This focuses on the magnitude and nature of the risks associated with untreated waste and/or treatment residuals. This criterion includes consideration of the adequacy and reliability of any associated engineering controls, such as monitoring and maintenance requirements.
4. Reduction of contaminant toxicity, mobility, or volume through treatment. This includes the degree to which the alternative employs treatment to reduce the toxicity, mobility, or volume of the contamination.
5. Short-term effectiveness. This includes the effect of implementing the alternative relative to the potential risks to the general public, potential threat to workers, and the time required until protection is achieved.
6. Implementability. These are potential difficulties associated with implementing the alternative. This may include the technical feasibility, administrative feasibility, and the availability of services and materials.
7. Cost. The costs associated with the alternatives include the capital cost, annual operation and maintenance (O&M), and the combined net present value.
8. State acceptance.
9. Community acceptance. This includes the consideration of any formal comments by the community to the PRAP for interim remedial action.

The criteria listed above are categorized into three groups. The first and second criterion are threshold criteria. The chosen final alternative must meet the threshold criteria to be eligible for selection. The five primary balancing criteria include criteria three through seven. The last two criteria are termed the modifying criteria. The modifying criteria were evaluated following issuance of the PRAP for public review and comment.

Overall Protection of Human Health and the Environment

Alternative 1, No Action, would not initiate hydraulic plume control. The purpose of including the No Action Alternative is to provide a baseline to which other alternatives can be compared. Existing controls such as ground water monitoring, alternate water supply, and agreements on water-use restrictions would be continued. The water policy represents only institutional controls and does not meet EPA's bias for permanent solutions involving treatment of the contaminated media. (i.e., It does not return the ground water to beneficial use.) These controls include:

- Public awareness programs that advise local residents of site conditions and potential problems resulting from ground water contamination;

- An alternative water supply for residents whose wells have been affected. Also, an action memorandum was approved by the EPA to extend a West McCracken County Water District line to all residents whose wells have the potential to be contaminated in the future. The water policy requires that these residents sign an agreement not to use their wells. Construction of the pipeline (water main) has recently been completed; and
- The annual site environmental monitoring program.

Alternative 2, Hydraulic Plume Control, will initiate an effort toward returning the ground water to beneficial use by controlling the high concentration area of the plume. Future site risk will be reduced since ground water will be extracted and treated. This alternative alone is not intended to remediate the plume to MCLs; however, water that is extracted will be treated to meet compliance concentrations.

Alternative 2 would accomplish the interim remedial action objectives of initiating hydraulic control of the plume and initiating risk reduction along with facilitating collection of data needed for selecting subsequent and future final remedial actions. It would also reduce future risks associated with continued migration of the high concentration area of the plume and resulting exposures. This alternative features treatment of extracted ground water to meet effluent discharge limits which meets EPA's preference for treatment, and subsequently is preceding toward the preference for a permanent solution. Successful control of the plume in combination with existing controls (alternate water supply, monitoring, etc.) ensures protection during the period of the interim response. However, the risk cannot be quantified until a baseline risk assessment has been conducted at the Northeast Plume.

Compliance with Applicable or Relevant and Appropriate Requirements

An alternative must meet this threshold criterion to be eligible for selection. Alternative 1 would not provide compliance with ARARs since migration of ground water contamination would not be reduced. Alternative 2 would provide compliance with ARARs. A detailed description of ARARs for the selected remedy is presented in Section 2.10 of this ROD.

On July 2, 1993, the DOE was directed by the KDEP and the EPA to submit a workplan to implement an interim measure at the Northeast Plume. This interim remedial action will be initiated pursuant to the Interim Measure Provisions of PGDP's Kentucky Hazardous Waste Management Permit issued by the KDEP, the Hazardous and Solid Waste Amendments Permit issued by the EPA, and this ROD. The Kentucky Division of Waste Management concurs with the DOE and the EPA on the selected interim action, in accordance with the requirements of the Kentucky Hazardous Waste Management Permit. The scope of this action warrants the incorporation of the selected remedy into the Commonwealth's Hazardous Waste permit. This ROD will serve as the primary document for the modification to the Commonwealth's Hazardous Waste permit. This action will serve as a step toward comprehensively addressing the Northeast Plume.

In ROD documentation, the CERCLA requires that the RCRA be listed as an ARAR. By doing this, it in no way limits, takes away, or negates the Commonwealth of Kentucky's RCRA authority at the site.

Long-term Effectiveness and Permanence

The No Action Alternative could cause potential health and environmental impacts to occur through a future exposure scenario. The extraction and treatment system is intended as an interim remedial action until sufficient information can be accumulated to formulate the final solution for this integrator operable unit. This action is intended to be consistent and appropriate with the final remedial action. The effectiveness and efficiency of this system will be evaluated for potential final actions.

Reduction of Contaminant Toxicity, Mobility, or Volume through Treatment

Alternative 2, Hydraulic Plume Control, would reduce the mobility and volume of the contaminated

ground water, and will reduce the toxicity within the extracted and treated water until a final action is taken. The volume of contaminant reduction will depend upon the length of time the interim remedial action is implemented. This action will be reviewed within five years after initiation. Construction is scheduled to be completed within two years, with approximately three years of operation and maintenance.

Short-Term Effectiveness

Alternative 1, No Action, would not entail new controls. Therefore, no additional impacts to short-term human health and the environment would be encountered.

Alternative 2, Hydraulic Plume Control, will not pose a threat to either nearby communities or the workers associated with the operation and maintenance of the treatment system. Workers associated with the construction and operation of the source control systems will abide by the requirements of a site-specific health and safety plan (HSP). The HSP will be prepared as part of the bid package and submitted to the selected contractor prior to the award of the project. Prior to implementation of this interim remedial action, the EPA and the KDEP will be afforded the opportunity to review the HSP. The draft HSP will be modified by the contractor to reflect pertinent comments submitted by the regulatory agencies. Standard engineering controls would also be implemented to mitigate any potential environmental impacts. Construction start-up for the alternative is possible within 15 months of the signature of this interim remedial action ROD and could be effective until a final ROD is implemented.

Implementability

Alternative 1, No Action, could be readily implemented. Additional technical and administrative procedures would not be conducted other than those currently conducted for the alternative water supply and ground water monitoring.

Alternative 2, Hydraulic Plume Control, is technically and administratively feasible. Extraction wells and monitoring wells can be readily constructed using standard equipment and technologies. Numerous services and materials for construction are readily available, and the likelihood of competitive bids would be expected. Administrative difficulties are not expected to be encountered when fulfilling the necessary procedures for obtaining surface water discharge approval.

Costs

Cost estimates for each alternative are based upon the Northwest Plume Interim ROD and contract information and are expressed in terms of 1995 dollars. The costs for Alternative 2, Hydraulic Plume Control, and the two treatability studies are listed below:

- Present worth cost: \$5,291,000;
- Capital cost: \$4,851,000; and
- O&M costs (3 years combined): \$1,283,000.

A cost estimate is included for the interim remedial action. The estimate is based upon feasibility-level scoping and is intended to aid in making project evaluations. The estimate has an expected accuracy of +50 to -30% for the proposed scope of the action. Alternative 2))Cooling Towers and Treatability Studies Cost Breakdown can be found in Table 1; Alternative 2))Cooling Towers Cost Breakdown, Table 2; In Situ Ground Water Study Cost Breakdown, Table 3; and Photocatalytic Oxidation Pilot Study Cost Breakdown, Table 4.

State Acceptance

The Northeast Plume Technical Memorandum, PRAP, and draft ROD were issued for review and comment to both the KDEP and the EPA. The KDEP concurs with this action, consistent with the requirements of the Commonwealth of Kentucky's Hazardous

Waste Permit.

Community Acceptance

No groups and organizations opposed this interim remedial action. Community response to the alternatives is presented in the responsiveness summary which addresses comments received during the public briefing and the public comment period.

2.9 Selected Remedy

Based upon the evaluation of the alternatives in regard to the nine criteria, the remedy jointly selected by the EPA, the KDEP, and the DOE is Alternative 2, Hydraulic Plume Control. The DOE will prepare a detailed design of the treatment unit in accordance with the requirements of the ROD for this interim remedial action, and in accordance with the ICM Workplan for the Northeast Plume. The ICM Workplan, pursuant to the PGDP's Kentucky Hazardous Waste Management Permit and EPA HSWA permit, will be approved at the same time as this ROD. The selected remedy will be included in the Kentucky Hazardous Waste Permit by way of a permit modification, as a corrective action requirement.

The selected remedy will consist of the following elements at a minimum:

- (1) Extraction of contaminated water from a well field location on DOE property near the northern portion of the high concentration area of the off-site Northeast Plume;
- (2) Treatment of extracted ground water contaminated with TCE and 1,1-DCE;
- (3) Surface discharge; and
- (4) Demonstration of two innovative pilot treatment studies.

Table 1. Alternative 2))Cooling Towers and Treatability Studies Cost Breakdowna

Project Cost Item	Costs (\$ Thousands)b
Capital Costs	
Direct Cost	
Monitoring & Extraction Wells	738
Transfer Piping	186
Sand Filter Building	364
In Situ Treatability Study	493
Photocatalytic Oxidation Pilot Study	96
Waste Management	283
Misc. Support & Training	98
Construction Management	547
Direct Total Cost	2805
Indirect Cost	
Engineering Expenses	851
Administration Costs	514
Contingency (Indirect & Direct)	681
Indirect Total Cost	2046
Total Capital Cost	4851
O&M Costs	
O&M Costs (1st year):	
Administration Costs	164
Sampling, Analysis & Operations	228
1st Year O&M Costs	392
O&M Costs (2nd year)	
Administration Costs	190
Sampling, Analysis & Operations	206
2nd year O&M Costs	396
O&M Costs (3rd year)	
Administration Costs	97
Sampling, Analysis & Operations	145
3rd year O&M Costs	242
Total O&M Contingency	253
Total O&M Costs	1283
Total Project Cost in Escalated Dollars	6134
Present Worth Costs	
Total Alternative 2 Present Worth Costs:	5291
[Per Building Life Cycle Cost Analysis (Version 4.20-95)]	

a Per Guidance Document EPA/540/G-89/004, Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA

b Escalated (average 3.7% escalated rate per DOE Guidance)

Table 2. Alternative 2))Cooling Towers Cost Breakdowna

Project Cost Item	Costs (\$ Thousands)b
Capital Costs	
Direct Cost	
Monitoring & Extraction Wells	738
Transfer Piping	186
Sand Filter Building	364
Waste Management	108
Misc. Support & Training	98
Construction Management	395
Direct Total Cost	1889
Indirect Cost	
Engineering Expenses	629
Administration Costs	432
Contingency (Indirect & Direct)	498
Indirect Total Cost	1559
Total Capital Cost	3448
O&M Costs	
O&M Costs (1st year):	
Administration Costs	90
Sampling, Analysis & Operations	139
1st Year O&M Costs	229
O&M Costs (2nd year)	
Administration Costs	95
Sampling, Analysis & Operations	145
2nd year O&M Costs	240
O&M Costs (3rd year)	
Administration Costs	97
Sampling, Analysis & Operations	145
3rd year O&M Costs	242
Total O&M Contingency	177
Total O&M Costs	888
Total Project Cost in Escalated Dollars	4336
Present Worth Costs	
Total Alternative 2 Present Worth Costs:	3791
[Per Building Life Cycle Cost Analysis (Version 4.20-95)]	

a Per Guidance Document EPA/540/G-89/004, Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA

b Escalated (average 3.7% escalated rate per DOE Guidance)

Table 3. In Situ Ground Water Study Cost Breakdowna

Project Cost Item	Costs (\$ Thousands)b
Capital Costs	
Direct Cost	
Waste Management	175
In Situ Treatability Study	493
Construction Management	152
Direct Total Cost	820
Indirect Cost	
Engineering Expenses	176
Administration Costs	45
Contingency (Indirect & Direct)	156
Indirect Total Cost	377
Total Capital Cost	1197
O&M Costs	
O&M Costs (1st year):	
Administration Costs	61
Sampling, Analysis & Operations	58
1st year O&M Costs	119
O&M Costs (2nd year)	
Administration Costs	95
Sampling, Analysis & Operations	61
2nd year O&M Costs	156
Total O&M Contingency	70
Total O&M Costs	345
Total Project Cost in Escalated Dollars	1542
Present Worth Costs	
Total Alternative 2 Present Worth Costs:	1346
[Per Building Life Cycle Cost Analysis (Version 4.20-95)]	

a Per Guidance Document EPA/540/G-89/004, Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA

b Escalated (average 3.7% escalated rate per DOE Guidance)

Table 4. Photocatalytic Oxidation Pilot Study Cost Breakdowna

Project Cost Item	Costs (\$ Thousands)b
Capital Costs	
Direct Cost	
Photocatalytic Oxidation Pilot Study	96
Direct Total Cost	96
Indirect Cost	
Engineering Expenses	46
Administration Costs	37
Contingency (Indirect & Direct)	27
Indirect Total Cost	110
Total Capital Cost	206
O&M Costs	
O&M Costs (1st year):	
Administration Costs	13
Sampling, Analysis & Operations	31
(3 months) O&M Costs	44
Total O&M Contingency	6
Total O&M Costs	50
Total Project Cost in Escalated Dollars	256
Present Worth Costs	
Total Alternative 2 Present Worth Costs:	227
[Per Building Life Cycle Cost Analysis (Version 4.20-95)]	

a Per Guidance Document EPA/540/G-89/004, Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA

b Escalated (average 3.7% escalated rate per DOE Guidance)

Contaminated water will be extracted from one or more wells located near the northern end of the high concentration area. Water will be pumped through underground piping to the treatment unit. Water will likely be pumped to a sand filter to remove suspended solids and then be pumped through an existing cooling tower for the removal of VOCs. Treated water will be discharged to a KPDES permitted surface water outfall. The DOE will evaluate the concentrations of TCE, TCE degradation products, and 99Tc in the effluent from the treatment system and monitoring wells to ensure that this interim remedial action is protective of both human health and the environment.

Current 99Tc concentrations in the Northeast Plume outside the plant's security fence are at levels which do not pose a potential threat to human health or the environment upon surface discharge. Technetium-99 was detected at a maximum concentration of 58 pCi/l. However, this concentration is well below the calculated concentration allowed for drinking water (900 pCi/l). Influent water (e.g., extracted ground water) will be sampled for 99Tc during the interim action to assure that threshold limits are not exceeded. Routine sampling will be performed for 99Tc in ground water monitoring wells. The monitoring system will include those wells installed as part of this interim remedial action and existing monitoring wells located upgradient of the extraction well field. These monitoring wells should provide sufficient notification for institution of corrective measures should significant concentrations of this radionuclide be detected.

The TCE off-gas concentrations are not expected to exceed the Commonwealth of Kentucky air regulations (401 K.A.R. 63:022). Assuming ground water concentrations of 1,000 :g/l, approximately 6.3×10^{-6} kilograms per second (0.05 pounds per hour) of TCE will be released to the atmosphere. This level is less than the regulatory significant level, with height correction. Therefore, no off-gas treatment is proposed.

2.10 Statutory Determinations

The DOE, the EPA, and the KDEP concur that the selected remedy will satisfy the statutory requirements of K.R.S. 224.46-530 and CERCLA 121(b) and the Hazardous Waste Permit for providing protection of human health and the environment, attaining ARARs directly associated with this action, being cost effective, utilizing alternative treatment technologies to the maximum extent practicable, and exhibiting a preference for treatment as a principal element.

Protection of Human Health and the Environment

The interim remedial action remedy initiates protection of human health for PGDP employees and the public through mitigation of contaminants from the Northeast Plume until a final action is determined. The remedy also provides protection for the environment by providing treatment of the effluent prior to discharge into the KPDES outfall, and effective management of all residual wastes generated during implementation of the action.

Compliance with Applicable or Relevant and Appropriate Requirements

Congress specified in the CERCLA § 121 that remedial actions for cleanup of hazardous substances and constituents must comply with requirements, criteria, standards, or limitations under federal or more stringent state environmental laws that are applicable or relevant and appropriate to the hazardous substances and constituents or circumstances at a site. Applicable or relevant and appropriate requirements are utilized to ensure the protection of human health and the environment.

In ROD documentation, the CERCLA requires that the RCRA be listed as an ARAR. By doing this, it in no way limits, takes away, or negates the Commonwealth of Kentucky's RCRA authority at the site.

The following is an explanation of the terms used throughout this document:

Applicable requirements are "those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that specifically address a hazardous substance,

pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site" (40 C.F.R. §300.5).

Relevant and appropriate requirements are "those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that, while not applicable to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site" (40 C.F.R. § 300.5).

Chemical-specific requirements are usually "health- or risk-based numerical values or methodologies which, when applied to site-specific conditions, result in the establishment of numerical values" (53 Fed. Reg. 51437, December 21, 1988). These values establish the acceptable amount or concentration of a chemical that may remain in, or be discharged to, the ambient environment.

Location-specific requirements "generally are restrictions placed upon the concentration of hazardous substances and constituents or the conduct of activities solely because they are in special locations" (53 Fed. Reg. 51437, December 21, 1988). Some examples of special locations include floodplains, wetlands, historic places, and sensitive ecosystems or habitats.

Action-specific requirements "are usually technology- or activity-based requirements or limitations on actions taken with respect to hazardous wastes or requirements to conduct certain actions to address particular circumstances at a site" (53 Fed. Reg. 51437, December 21, 1988). Selection of a particular remedial action at a site would invoke the appropriate action-specific ARARs that may specify particular performance standards or technologies, as well as specific environmental levels for discharged or residual chemicals.

Requirements under federal or state law may be either applicable or relevant and appropriate to CERCLA cleanup actions, but not both. However, if a requirement is not applicable it must be both relevant and appropriate for compliance to be necessary. In the cases where both a federal and a state ARAR are available, or where two potential ARARs address the same issue, the more stringent regulation must be selected. However, CERCLA § 121(d)(4) provides several ARAR waiver options that may be invoked, providing that the primary requirement of protection of human health and the environment is met.

The CERCLA remedial actions conducted entirely onsite, as defined in 40 C.F.R. § 300.5, must comply with the substantive provisions of laws and regulations but not procedural or administrative requirements. Substantive requirements pertain directly to the actions or conditions at a site, while administrative requirements pertain to permitting, documenting, and processing regulatory review and decision making. Response actions conducted entirely onsite are not required to obtain federal, state or local permits. In order to ensure that CERCLA response actions proceed as rapidly as possible, the EPA has re-affirmed this position in the final NCP (55 Fed. Reg. 8756, March 8, 1990).

Other information that does not meet the definition of an ARAR may be necessary to determine what is protective or may be useful in developing Superfund remedies. In addition, ARARs do not exist for every chemical or circumstance likely to be found at a Superfund site. Therefore, the EPA believes it may be necessary, when determining cleanup requirements or designing a remedy, to consult reliable information that would not otherwise be considered a potential ARAR (55 Fed. Reg. 8745, March 8, 1990). Criteria or guidance developed by the EPA, other federal agencies, or states may assist in determining, for example, health-based levels for a particular contaminant or the appropriate method for conducting an action for which there are no ARARs. This other information is to be considered (TBC) guidance and may be used when developing CERCLA remedies. The TBC guidance generally falls within three categories: (1) health effects information; (2) technical information on how to perform or evaluate investigations or response actions; and (3) policy.

Response actions under the NCP will comply with the provisions for response action worker safety and health in 29 C.F.R. 1910.120 (40 C.F.R. § 300.150). The Occupational Safety and Health Act

and its corresponding regulations are applicable to the PGDP. These standards are designed to protect the health and safety of workers. However, these standards must be complied with although they are not ARARs.

Applicable or Relevant and Appropriate Requirements for Alternative 2))Hydraulic Plume Control

Chemical-specific applicable or relevant and appropriate requirements

Discharges of the treated ground water into an outfall must comply with Kentucky's antidegradation statute. Surface waters of Kentucky must be safeguarded against the creation of any new pollution (401 K.A.R. 5:029 § 2). Furthermore, where the quality of surface water exceeds that which is necessary to support reproduction of fish and wildlife, and human recreation in and on the water, the quality shall be maintained and protected. This is an applicable standard.

Treated water discharged into an outfall, must comply with 401 K.A.R. 5:031 and 5:050. These requirements are applicable, and the substantive requirements will be implemented. The PGDP has in place a KPDES permit (KY 0004049). This permit incorporates Clean Water Act (CWA) requirements under Kentucky regulations and establishes limitations for various chemicals including TCE at KPDES outfalls. Concentrations of TCE may not exceed .081 mg/l at the outfall. The KPDES permit requires the compliance point to be at the nearest accessible point after final treatment, but prior to actual discharge to or mixture with receiving waters. Under 401 K.A.R. 5:029, the terms "surface water" or "receiving waters" do not include ditches used for water treatment which are under valid easement by a permitted discharger. In addition, pursuant to 401 K.A.R. 5:070, if any chemical will be discharged through a KPDES outfall that is not regulated by the permit, the permit must be modified to include the chemical.

Maximum contaminant levels under the Safe Drinking Water Act (40 C.F.R. § 141) and Kentucky Administrative Regulations (401 K.A.R. 8:250-420) would not be relevant and appropriate to this alternative. As an interim remedial action, the scope is limited to control of the high concentration contamination area within the Northeast Plume, so treatment to MCLs would not be appropriate at this phase.

Location-specific applicable or relevant and appropriate requirements

Protected resources referred to in this section are present on the operable unit; however, no adverse impacts to these resources are currently anticipated. Consequently, although all ARARs discussed in this section are applicable, they will be met by avoidance of the resources. However, if impacts become apparent, due to construction or other plan modifications, additional requirements (e.g., consultation with the Fish and Wildlife Service (FWS) or the State Historic Preservation Officer (SHPO) concerning endangered species and cultural resources respectively, mitigation for impacts to wetlands, etc.) will need to be addressed and/or initiated to comply with the ARARs.

Wetlands and floodplains have been identified in the area of the Northeast Plume. Construction of the ground water treatment facility and extraction wells must avoid or minimize adverse impacts on wetlands and act to preserve and enhance their natural and beneficial values [Executive Order 11990, 40 C.F.R. § 6.302(a), 40 C.F.R. Part 6; Appendix A, and 10 C.F.R. Part 1022]. In addition, the facilities must not be constructed in a 100-year floodplain (Executive Order 11988, and 10 C.F.R. 1022).

Construction in wetlands should be avoided unless there are no practicable alternatives [40 C.F.R. § 6.302(a)]. Degradation or destruction of wetlands must be avoided to the extent possible [40 C.F.R. § 230.10 and 33 U.S.C. § 1344(b)(1)]. Considerations about protection of wetlands must be incorporated into planning, regulating, and decision making [10 C.F.R. § 1022.3(b)]. Any action involving the discharge of dredged or fill material into wetlands must be avoided to the extent possible (13 U.S.C. § 1344, 40 C.F.R. Part 230, and 33 C.F.R. Parts 320 to 330).

Discharges of dredged or fill material for which there are practicable alternatives with fewer

adverse impacts, or those which would cause or contribute to significant degradation are prohibited [40 C.F.R. § 230.10(a)]. Discharges are also prohibited unless there are no practicable alternatives, and practicable, appropriate mitigation methods are available [40 C.F.R. §230.10(d)]. Further, 40 C.F.R. § 230.10(b) prohibits discharges that cause or contribute to violations of state water quality standards, violate toxic effluent standards or discharge prohibitions (33 U.S.C. § 1317), or jeopardize threatened or endangered species or their critical habitat under the endangered species act (16 U.S.C. § 1531, et seq.). If it becomes apparent that impacts to wetlands are unavoidable, due to construction plan or other modifications, the specific requirements of 33 C.F.R. § 330 [nation wide permits (NWP)], or 33 C.F.R. § 325 (processing of general permits), and statutes governing discharges of dredged or fill material into waters of the United States would become applicable.

Specific requirements of NWP 12 (Utility Line Backfill and Bedding) and general permits that would be applicable to this project, if impacts become apparent, include but are not limited to: (1) avoiding and minimizing impacts to the fullest extent possible, (2) incorporation of erosion control measures and best management practices (BMPs) into construction plans, (3) avoiding stockpiling of materials in waters of the United States including wetlands, and (4) keeping heavy equipment out of waters of the United States including wetlands whenever possible. If it is determined that this is not possible, heavy equipment must be placed on mats or other measures implemented to minimize soil disturbance. Specific requirements would be better defined once the nature and extent of impacts and appropriate permit(s) are determined.

Under the Endangered Species Act (16 U.S.C. § 1531 et seq.), federal agencies are prohibited from jeopardizing threatened or endangered species or adversely modifying habitats essential to their survival [40 C.F.R. § 6.302(h)]. All designated endangered or threatened species or their habitats must be identified [40 C.F.R. § 6.302(h)]. Two federally endangered or candidate species have been documented to exist in the surrounding area: the Indiana bat and the copperbelly water snake. Sixteen additional federally listed or candidate species have been reported from surrounding McCracken and Ballard counties. Of these 18 species only the Indiana bat, copperbelly water snake, Rafinesque's big-eared bat, and southeastern myotis have possible habitats present near the treatment areas. No impacts to any of these species or their habitats are anticipated at this time. If it becomes apparent that impacts to any of these species or their habitats are unavoidable, due to construction plan or other modifications, formal consultation with the FWS must be initiated pursuant to 50 C.F.R. § 402. If the consultation reveals that the activity may jeopardize a listed species or habitat, mitigation measures should be considered [116 U.S.C. § 1531-1544, 50 C.F.R. Part 402, 40 C.F.R. § 6.302(h), and 16 U.S.C. § 661-668]. Since the State Threatened and Endangered Species List has not been promulgated, it is TBC guidance.

Under the National Historic Preservation Act (NHPA) (16 U.S.C. § 470), federal agencies are required to exercise caution to ensure that no properties that may qualify as cultural or historic be inadvertently demolished, altered, or affected. Section 106 of the NHPA requires a federal agency to take into account the effects of its undertaking on properties included in or eligible for the National Register of Historic Places, and, prior to approval of an undertaking, to offer the Advisory Council on Historic Preservation a reasonable opportunity to comment on the undertaking (36 C.F.R. § 800). This is accomplished by following the "Section 106 process" (36 C.F.R. § 800).

In general, the Section 106 process includes: reviewing existing information on historic properties potentially affected by the undertaking; requesting information from local governments, Indian tribes, public and private organizations, and other parties likely to have knowledge of or concerns with historic properties in the area; and surveying the area to determine the location of unknown properties or sites. If no properties are discovered using the above methods, the agency will provide this documentation to the SHPO and any interested parties, and no further steps are required. If historic properties are found, the properties must be assessed to determine effects pursuant to 36 C.F.R. § 800.5. Generally, if no known sites are found through the review and information request process, and the area of the undertaking is undisturbed, a survey of the area is required. However, if the area of the undertaking is within a previously disturbed area, and the SHPO concurs, no further steps are required.

The areas chosen for the site of the extraction wells and water treatment facility were surveyed during a study conducted by the United States Army Corps of Engineers in 1993. No historic or cultural properties were discovered during the survey. Consequently, if the pipeline route is restricted to previously disturbed areas (i.e., under the existing road or within adjacent created ditches) and the location of the extraction wells and water treatment facility does not change, the Section 106 process is fulfilled upon concurrence with the SHPO. However, if the pipeline cannot be confined to previously disturbed areas and/or the location of the extraction wells and/or the water treatment facility changes, a survey of the new areas may be required upon consultation with the SHPO.

Under the Farmland Protection Policy Act (7 C.F.R. § 658), federal agencies are required to: take into account the adverse effects of their programs on the preservation of farmlands; consider alternatives, as appropriate, to lessen adverse impacts to farmlands; and ensure that their programs, to the extent practicable, are compatible with state and local government and private programs to protect farmland.

Prime farmland soils have been identified in the area of the proposed action; however, less than 0.01 acre is presently being considered for conversion. Consequently, consultation with the Soil Conservation Service has determined that it is not necessary to complete Form AD 1006, the Farmland Conversion Impact Rating Form, to determine the impact of the undertaking on prime farmland. If modifications are made to the current plans, more prime farmland may be impacted and Form AD 1006 would need to be completed.

Action-specific applicable or relevant and appropriate requirements

Site preparation and construction activities (i.e., extraction/monitoring wells, pipeline, and sand filters) will be conducted in order to implement the interim remedial action. Such construction activity could produce airborne pollutants. Particulate emission levels resulting from earth-moving and site-grading activities may exceed the Kentucky air quality regulations found in 401 K.A.R. 63:010 et seq. The Kentucky air quality regulations contain general standards of performance governing fugitive dust emissions. The regulations in 401 K.A.R. 63:010 § 3 require the use of water or chemicals, if possible, and/or placement of asphalt or concrete on roads and material stockpiles to control dust. Visible fugitive dust may not be discharged beyond the property line where the dust originated. Additionally, all open bodied trucks which operate outside the property boundary and which may emit materials that could be airborne must be covered. This regulation would be applicable.

Storm water discharges from activities at industrial sites involving construction operation will be regulated by the KPDES Permit (KY0004049) established under 401 K.A.R. 5:055. The PGDP is exempted from the Kentucky General Permit for Storm Water Point Sources (KYR100000) under 401 K.A.R. 5:055 because it has an individual KPDES Permit. Pursuant to 401 K.A.R. 5:055, the PGDP's KPDES Permit specifies that BMPs and sediment and erosion controls be implemented at a site to control storm water runoff. The PGDP has developed a BMP plan pursuant to these requirements which are applicable.

The cooling towers meet the definition of "waste water treatment facility" under 401 K.A.R. 30:010 § 1(90)(t); therefore, they are exempt from RCRA regulation pursuant to 401 K.A.R. 38:010 § 1(2)(b)(5). The facility will be regulated under the CWA and the site's KPDES permit. Under 401 K.A.R. 5:005 § 7, treatment systems from industrial wastes must be designed according to specific criteria. Also, the KPDES permit will have to be modified to include the cooling towers as a waste source.

The Kentucky regulations, in 401 K.A.R. 5:005 § 7, specify that design criteria for any facility, including wastewater treatment units such as the cooling tower, shall be controlled by current engineering practices. Facilities must also protect those minimum conditions applicable to all waters of the Commonwealth found in 401 K.A.R. 5:031 § 2. Furthermore, facilities shall not cause those waters classified in 401 K.A.R. 5:035 to be of lesser quality than the numeric criteria applicable to those waters in 401 K.A.R. 5:031 §§ 3 to 9. These requirements are applicable to this action.

Additionally, 401 K.A.R. 5:005 § 7 of the regulations requires that a recording flow measuring device be installed at each large facility. As defined in 401 K.A.R. 5:005 § 8, a "large facility" means a treatment facility with an average daily design flow of 50,000 gallons (gal) per day or more and sewer lines of more than 50,000 ft. These requirements are applicable to this action.

The cooling tower will be used to remove VOCs from the ground water. As a modified source it would be regulated by the requirements in 401 K.A.R. 63:022 § 3, which specify that no owner or operator shall allow any source to exceed the allowable emission limit determined by the formula in Appendix A of that regulation. If the owner or operator cannot meet the allowable emission limit even after application of best available control technology, and can demonstrate this fact to the satisfaction of the Cabinet, then best available control technology shall be required. However, calculations by both the DOE and the KDEP agree that the allowable emission rate will not be exceeded.

The construction of water wells is regulated by the Commonwealth of Kentucky. Construction of water withdrawal wells will require that the wells be constructed by a certified driller under specified design criteria (401 K.A.R. 6:310 § 13). A permit is required when more than 10,000 gal of water per day are pumped out of the ground (401 K.A.R. 4:010 § 1). However, the DOE is exempt from permits and other administrative requirements under CERCLA § 121 (c)(1), but will be required to record and report the recovery rate. All substantive requirements of this regulation will apply.

During well installation, investigation-derived waste and personal protective equipment could meet the definition of a characteristically hazardous waste. Operational residuals from sand filters may also be above characteristically hazardous waste levels. A determination will be made on any such waste as required under 401 K.A.R. 32:010 § 2. Kentucky regulations applicable to generators of hazardous waste are detailed in 401 K.A.R. Chapter 32 et seq. It should be noted that aqueous waste associated with well installation and operations will be treated in the cooling towers or another wastewater treatment unit on site. This water will be exempt from the RCRA regulations as specified in the wastewater treatment unit exemption.

Any solid waste deemed characteristically hazardous under the RCRA could be moved to a less than 90-day storage facility at the PGDP. Pursuant to 401 K.A.R. 32:030 § 5, on-site accumulation of hazardous waste may occur for 90 days or less without modifying the RCRA permit, if the waste is placed in containers that comply with 401 K.A.R. 35:180. Selected requirements for the use and management of containers holding hazardous waste being accumulated onsite for less than 90 days are defined in 401 K.A.R. 35:180. The regulation requires that containers holding the waste be in good condition. Also, the waste must be stored in containers lined with materials that are compatible (401 K.A.R. 35:180 § 3). Furthermore, containers must be managed to ensure that they are always closed during storage, except when necessary to add or remove waste; containers are not opened, handled, or stored in any manner which may rupture the container or cause it to leak; and the containers are labeled with the notation "hazardous waste" and the date the accumulation begins (401 K.A.R. 35:180 § 4). These selected requirements are applicable to the management of hazardous waste stored onsite for less than 90 days. However, on-site accumulation of as much as 55 gallons of hazardous waste or one quart of acutely hazardous waste may occur for more than 90 days, provided §§ 2, 3 and 4(1) of 401 K.A.R. 35:180 are followed and the containers are marked with the notation "hazardous waste." These requirements would be applicable to any on-site storage of hazardous waste for less than 90 days.

Generators of hazardous waste must obtain an EPA identification number. The PGDP has an identification number and a current RCRA Part B permit. Generators must keep a copy of each manifest, a signed copy of the manifest returned from the designated facility which received the waste, annual reports, and exception reports for at least three years (401 K.A.R. 32:040 § 1). The generator must also maintain records of any test results, waste analyses, or other determinations for at least three years from the date that the waste was last sent to an on-site or off-site treatment storage, or disposal facility (401 K.A.R. 32:040 § 1).

All less than 90-day accumulation areas and permitted facilities at the PGDP will go through RCRA closure when removed from operation. Applicable requirements will be adhered to at that

time.

Pursuant to 401 K.A.R. 37:050 and 40 C.F.R. § 268.50, the storage of hazardous wastes restricted from land disposal under 401 K.A.R. 37:030 and 40 C.F.R. § 268 is prohibited, unless the generator stores such wastes in tanks, containers, or containment buildings onsite solely for the purpose of accumulating such quantities of hazardous waste as necessary to facilitate proper recovery, treatment, or disposal. Such storage at the PGDP must be in compliance with the requirements in 401 K.A.R. 32:030 § 5 and 401 K.A.R. Chapters 34 and/or the requirements in 40 C.F.R. § 264. Furthermore, each container must be clearly marked with the identification of its contents, the date each accumulation period began, and the quantity of each hazardous waste. These regulations apply to the management of hazardous wastes prohibited from land disposal that are stored onsite. The PGDP has a Part B permit in place which abides by these standards. Any hazardous waste from on-site wells or treatment residuals are included in the latest permit modification.

If wastes are shipped offsite for treatment and/or disposal, the regulations mandated in 49 C.F.R. §§ 172-179 will be applicable. Off-site shipments must comply with both the substantive and administrative requirements of these regulations. Materials designated as hazardous by the Department of Transportation are listed and classified in 49 C.F.R. §§ 172.101 and 102. Transportation, shipping requirements, package marking, labeling, transport vehicle placarding, and shipping paper(s) requirements are set forth in 49 C.F.R. Subparts C, D, E, and F.

Additional requirements which are applicable to the transportation of hazardous material are located in 401 K.A.R. Chapter 33. These regulations detail standards to which persons transporting hazardous waste in the United States must adhere including a manifest system, record keeping, and hazardous waste discharges. However, these regulations do not apply to on-site transportation of hazardous waste by generators or by owners or operators of permitted hazardous waste management facilities. The regulations in 49 C.F.R. § 172 would be applicable since they apply to each person who offers hazardous material for transportation and each carrier who transports the material. Specifications for packaging and containers used for the transportation of hazardous materials in commerce are included in 49 C.F.R. § 178. The PGDP abides by all applicable regulations for off-site transportation of hazardous material.

A transporter who intends to transport hazardous waste within the Commonwealth of Kentucky must have an EPA identification number issued by the Kentucky Natural Resources and Environmental Protection Cabinet (401 K.A.R. 33:010). The transporter must also register with the Cabinet by filing an application pursuant to 401 K.A.R. 33:010. Furthermore, the transporter of hazardous waste must meet the standards for compliance with the manifest system and record keeping found in 401 K.A.R. 33:020. These administrative requirements apply only to off-site shipments within the Commonwealth of Kentucky. Those hazardous and/or low-level wastes requiring off-site treatment or disposal must be sent to a facility which meets the EPA's acceptability criteria (40 C.F.R. 300.58). Those wastes generated by the action that requires off-site treatment or disposal will be sent to one or more of the following facilities: Envirocare of Utah, Clive, Utah; Rollins Environmental Services, Dear Park, Texas; Rollins Environmental Services, Baton Rouge, Louisiana; SEG, Oak Ridge, Tennessee; and TSCA Incinerator, Oak Ridge, Tennessee. These regulations are applicable to the offsite shipment of hazardous waste.

Requirements for providing and maintaining emergency response information during transportation and at facilities where hazardous materials are loaded for transportation, stored incidental to transportation or otherwise handled during any phase of transportation, are delineated in Subpart G of 49 C.F.R. § 172. However, an exemption is allowed for small quantities under the RCRA permit. Training requirements for hazardous materials training (HAZMAT) employees are included in Subpart H of 49 C.F.R. § 172. Training ensures that a HAZMAT employee has familiarity with Subpart H requirements, is able to recognize and identify hazardous materials, and has knowledge of emergency response information, self protection measures, and accident prevention methods and procedures. Under CERCLA § 121(e), administrative requirements for off-site transportation will be applicable.

Table 5 provides a listing of those applicable, relevant and appropriate, and TBC requirements as chemical-, location-, or action-specific.

Table 5. Applicable or Relevant and Appropriate Requirements (ARARs) and Guidance for the Northeast Plume
Hydraulic Plume Control

Actions	Requirements	Prerequisites	Federal Citation	Citation	Kentucky
CHEMICAL-SPECIFIC					
Antidegradation	Waters of the Commonwealth must be safeguarded against the creation of any new pollution.	Discharges into waters of the Commonwealth - applicable		5:029 § 2	
Treatment and discharge of the ground water into a surface water body	Must apply for KPDES permit modification for increased discharge to an outfall or to discharge a chemical not regulated by the permit.	Point-source discharge to waters of the Commonwealth - applicable		5:055	
	The discharge must comply with the KPDES effluent limitations of KY0004049 for an outfall. Specifically, the discharge must not exceed the permit limit for TCE of 0.081 mg/l at the outfall.	Point-source discharge to waters of the Commonwealth - applicable		5:080 § 1; 5:029 § 3	
LOCATION-SPECIFIC					
Protection of wetlands	Avoid or minimize adverse impacts on wetlands to preserve and enhance their natural and beneficial values.	Any federal action that will have an impact on wetlands - applicable	10 C.F.R. § 1022; Executive Order 11990		
	Avoid degradation or destruction of wetlands to the extent possible.	Any action involving discharge of dredge or fill material into wetlands - applicable	10 C.F.R. § 230.10; 13 U.S.C. § 1022.3(b)		
	Incorporate considerations about protection of wetlands into planning, regulating, and decision-making.	Any federal action that will have an impact on wetlands - applicable	10 C.F.R. § 1022.3(b) 33 C.F.R. § 330		

Table 5. Applicable or Relevant and Appropriate Requirements (ARARs) and Guidance for the Northeast Plume
Hydraulic Plume Control (continued)

Actions	Requirements	Prerequisites	Federal Citation	Kentucky Citation
LOCATION-SPECIFIC (continued)				
Discharge of dredged or fill material into navigable water	Discharges for which there are practicable alternatives with fewer adverse impacts or those which would cause or contribute to significant degradation are prohibited.	Any action involving discharge of dredged or fill material into wetlands - applicable	40 C.F.R. § 230.10(a)	
	Significant degradation is also prohibited unless there are practicable alternatives and practicable, appropriate mitigation methods are available.	Any action involving discharge of dredged or fill material into wetlands - applicable	40 C.F.R. § 230.10(c); 40 C.F.R. § 230.10(d)	
	Discharges which cause or contribute to violations of state water quality standards, violate toxic effluent standards or discharge prohibitions or jeopardize threatened and endangered species under the ESA.	Any action involving discharge of dredged or fill material into wetlands - applicable	40 C.F.R. § 230.10(b)	
Protection of floodplains	Avoid siting or construction in any 100-year floodplains.	Any federal action within a 100-year floodplain - applicable	10 C.F.R. 1022 Executive Order 11988	
Protection of threatened and endangered species	Avoid actions which jeopardize threatened or endangered species or take appropriate mitigation measures.	Any action which jeopardizes threatened or endangered species or their critical habitats - applicable	16 U.S.C. § 1531-1544; 50 C.F.R. § 402; 40 C.F.R. § 6.302(h)	

Table 5. Applicable or Relevant and Appropriate Requirements (ARARs) and Guidance for the Northeast Plume
Hydraulic Plume Control (continued)

Actions	Requirements	Prerequisites	Federal Citation	Kentucky Citation
LOCATION-SPECIFIC (continued)				
Protection of cultural resources	Ensure that no properties that may qualify as cultural or historic be inadvertently demolished, altered, or destroyed.	Any federal action that will have an impact on cultural resources - applicable	16 U.S.C.A. § 470	
	Avoid or minimize impacts to cultural resources by following the Section 106 process, including consultation with the SHPO.	Any federal action that will have an impact on cultural resources - applicable	36 C.F.R. § 800	
Protection of prime Farmland	Take into account agency action impacts on prime farmland and consider alternatives.	Conversion of prime farmland soils to non-farmable areas - applicable	7 C.F.R. § 658	
ACTION-SPECIFIC				
Site preparation and construction activities	Reasonable precaution must be taken to prevent particulate matter from becoming airborne.	Handling, processing, construction, road grading, and land clearing activities- applicable		401 K.A.R. 63:010 § 3
Surface water control	Implement good site planning and BMPs to control storm water discharges; comply with storm water runoff requirements of KPDES Permit KY 0004049.	Construction activities at industrial sites involving disturbance of five acres or more land - applicable if over five acres disturbed; - relevant and appropriate if less than five acres disturbed	40 C.F.R. § 122; 57 Fed. Reg. 41176 (Sept. 9, 1992)	

Table 5. Applicable or Relevant and Appropriate Requirements (ARARs) and Guidance for the Northeast Plume Hydraulic Plume Control (continued)

Actions	Requirements	Prerequisites	Federal Citation	Kentucky Citation
ACTION-SPECIFIC (continued)				
Waste water treatment facility	Exempt from RCRA under 401 K.A.R. 38:010 § 1(2)(b)(5).		(2)(b)(5)	38:010 § 1
	Designed according to specific criteria and controlled through current engineering practices.	Construction of a waste water treatment facility-applicable		5:005 § 7
	Protect those minimum conditions applicable to all waters of the Commonwealth.			
	Install a recording measuring device at each large facility.			
Water treatment facility (modified source)	No owner or operator shall allow any source to exceed the allowable emission levels determined in Appendix A of 401 K.A.R. 63:022.	Emissions from a treatment facility - applicable		63:022
Protection of aquatic organisms	Water criteria of 401 K.A.R. 5:031 must be maintained as well as appropriate criteria for other designated use classifications in 401 K.A.R. 5:026.	Action affecting the existing water quality-applicable	5:031	401 K.A.R.
Construction of water wells	Constructed by a certified driller under specified design criteria.	Construction of water withdrawal wells - applicable		6:310 § 1

Table 5. Applicable or Relevant and Appropriate Requirements (ARARs) and Guidance for the Northeast Plume
Hydraulic Plume Control (continued)

Actions	Requirements	Prerequisites	Federal Citation	Kentucky Citation
ACTION-SPECIFIC (continued)				
Waste management	Generators of waste shall determine if it is hazardous.	Generation of waste material - applicable	40 C.F.R. § 262.11	32:010 § 2
Container storage (onsite)	Storage in containers for less than 90 days.	Onsite storage of hazardous waste -applicable	40 C.F.R. § 262.34(a)	32:030 § 5(1)
	Containers must be in good condition and lined.	Storage of hazardous waste less than 90 days- applicable	40 C.F.R. § 265 Subpart I	35:180 § 4
	Containers must always be closed during storage except when necessary to add or remove waste; containers must not be handled in any manner which may rupture the container or cause it to leak; and must be labeled with the notation "hazardous waste."			
	Inspect container storage areas weekly for deterioration.		40 C.F.R. § 265.174	35:180 § 5

Table 5. Applicable or Relevant and Appropriate Requirements (ARARs) and Guidance for the Northeast Plume
Hydraulic Plume Control (continued)

Actions	Requirements	Prerequisites	Federal Citation	Kentucky Citation
ACTION-SPECIFIC (continued)				
Container storage (onsite) (continued)	Closure of 90-day accumulation areas shall minimize the need for further maintenance; control, minimize, or eliminate postclosure escape of hazardous waste; and comply with other closure requirements in 401 K.A.R. Chapter 35		40 C.F.R. § 262.34	35:070 § 2
	All contaminated equipment, structures, and soil shall be properly disposed or decontaminated.		40 C.F.R. § 262.37	35:070 § 5
	Storage in containers for more than 90 days.	Onsite storage - applicable	40 C.F.R. § 264	34:180
	Containers of hazardous waste must be:	Storage of containerized RCRA hazardous waste (listed or characteristic) not meeting small quantity by a generator criteria held for a temporary period before treatment, disposal, or storage elsewhere, in a container [i.e., any portable device (in) which a material is stored, transported, disposed, or handled] - Applicable to treatment of residuals or wastes which are RCRA hazardous wastes	40 C.F.R. § 264.171	34:180 § 2
	! Maintained in good condition;		40 C.F.R. § 264.172	34:180 § 3
	! Compatible with hazardous wastes to be stored; and		40 C.F.R. § 264.173	34:180 § 4
	! Closed during storage (except to add or remove waste).			
	Inspect container storage areas weekly for deterioration.		40 C.F.R. § 264.174	34:180 § 5

Table 5. Applicable or Relevant and Appropriate Requirements (ARARs) and Guidance for the Northeast Plume
Hydraulic Plume Control (continued)

Actions		Kentucky Prerequisites	Federal Citation	Citation
ACTION-SPECIFIC (continued)				
Container Storage (onsite) (continued)	Place containers on a sloped, crack-free base, and protect from contact with accumulated liquid. Provide containment system with a capacity of 10% of the volume containers, or, for liquids, the volume of the largest container, whichever is greater. Remove spilled or leaked waste in a timely manner to prevent overflow to the containment system.		40 C.F.R. § 264.175	34:180 § 6
	At closure, remove all hazardous waste and residues from the containment system and decontaminate or remove all containers, liners.		40 C.F.R. § 264.178	34:180 § 9

Table 5. Applicable or Relevant and Appropriate Requirements (ARARs) and Guidance for the Northeast Plume Hydraulic Plume Control (continued)

Actions	Requirements	Prerequisites	Federal Citation	Kentucky Citation
ACTION-SPECIFIC (continued)				
Tank storage (on site)	Storage in tanks for less than 90 days.	Onsite storage of hazardous waste - applicable	40 C.F.R. § 262.34(a)	32:030 § 5(1)
	Storage in tanks for less than 90 days.	Onsite storage - applicable	40 C.F.R. § 265 Subpart J	35:190
	Tanks for storage of hazardous waste must:			
	! Tank integrity assessment;		40 C.F.R. § 265.191	35:190 § 2
	! Meet design and construction standards;		40 C.F.R. § 265.192	35:190 § 3
	! Meet containment and release detection requirements;		40 C.F.R. § 265.193	35:190 § 4
	! Meet operating procedures;		40 C.F.R. § 265.194	35:190 § 5
	! Be routinely inspected;		40 C.F.R. § 265.195	35:190 § 6
	! Response to leaks or spills, Disposition of unfit tanks;		40 C.F.R. 264.196	35:190 § 7
	! Meet closure requirements;		40 C.F.R. § 265.197 [except § 265.197(c)]	35:190 § 8 [except§8(3)]

Table 5. Applicable or Relevant and Appropriate Requirements (ARARs) and Guidance for the Northeast Plume
Hydraulic Plume Control (continued)

Kentucky				
Actions	Requirements	Prerequisites	Federal Citation	Citation
ACTION-SPECIFIC (continued)				
Disposal of treatment residuals	Land disposal restrictions for RCRA hazardous waste may be triggered.	Disposal of RCRA restricted waste - applicable	40 C.F.R. § 268	Chapter 37
	Hazardous waste determinations are to be performed on treatment plant residuals.	Determination if a waste is RCRA hazardous waste - applicable	40 C.F.R. § 262.11	32:010 § 2
Transportation of hazardous waste (offsite)	Transporters of waste must follow detailed standards.	Waste exhibits a RCRA hazardous waste characteristic as defined by Subpart C of 40 C.F.R. 261 and off-site transportation occurs - applicable	40 C.F.R. § 263	Chapter 33
	Waste must be packaged and transported in accordance with DOT requirements including: shipping requirements, package marking, labeling, vehicle placarding, and shipping papers.	Hazardous waste is transported offsite - applicable	40C.F.R. § 263 Subparts A&B	
		The waste is considered a RCRA hazardous waste by characteristic or a hazardous substance that equals or exceeds a reportable quantity and transportation occurs in commerce - applicable	49 C.F.R. §§ 172, 173, 178, and 179	

Table 5. Applicable or Relevant and Appropriate Requirements (ARARs) and Guidance for the Northeast Plume Hydraulic Plume Control (continued)

Actions	Requirements	Prerequisites	Kentucky	Federal Citation	Citation
ACTION-SPECIFIC (continued)					
Transportation of hazardous waste (offsite) (continued)	Emergency response information and employee HAZMAT are required.			49 C.F.R. § 172	
	Transporter must have EPA identification number issued by the Kentucky Natural Resources and Environmental Protection Cabinet.	Transportation of hazardous materials in the Commonwealth of Kentucky - applicable			33:010

RCRA listed as an ARA is a requirement of CERCLA in ROD documentation. By doing this, it in no way limits, takes away, or negates the Commonwealth of Kentucky's RCRA authority at the site.

Cost effectiveness

The interim remedial action remedy employs a proven technology which affords overall effectiveness proportional to its costs such that the remedy represents reasonable value. This action will utilize a relatively inexpensive technology to initiate control of the spread of the highly contaminated portion of the Northeast Plume.

Utilization of permanent solutions and alternative treatment technologies

The objectives for this interim remedial action are to initiate hydraulic plume control to decrease the migration of contaminants from the high concentration zones of the Northeast Plume, and by installing innovative technologies which may provide more efficient and cost effective methods for addressing the plume. This action should provide protection for human health and the environment. However, it is not intended to fully address the principal threats to human health and the environment posed by the northeast operable unit. This is not the final action planned for the Northeast Plume contamination. Subsequent actions will fully address the principal threats posed by the conditions at the PGDP. Utilization of a permanent solution will be addressed in the final decision document for the site.

Preference for treatment as a principal element

This interim remedial action satisfies the statutory preference for treatment of the discharged effluent as a principal element of the containment system.

2.11 Documentation Of Significant Changes

The Proposed Remedial Action Plan for Interim Remedial Action of the Northeast Plume, was released for public comment on March 12, 1995. The PRAP identified Alternative 2, Hydraulic Plume Control as the preferred alternative. During the public comment period the selected remedy was further developed to decrease the project cost and time to implementation. After several discussions with the EPA, the KDEP, and the USEC, it was agreed that the DOE would utilize existing facilities to treat the ground water. Therefore, the decision was made to use the existing cooling towers for volatilization of the VOCs. This modification is consistent with the type of treatment specified in the PRAP and will result in a comparable level of treatment. As public noticed in the PRAP, the ground water extraction wells and pipeline will be used and the treated ground water will be discharged to a KPDES outfall. The DOE has reviewed all written and verbal comments submitted during the public comment period. Upon review of these comments, it was determined that no significant changes to the remedy, as it was originally identified in the PRAP, were necessary.

During the development of the final remedial alternatives for the Ground Water Integrator Operable Unit, including the Northeast Plume, the necessity of action implemented under this ROD for interim remedial action will be re-evaluated. The final ROD for the Ground Water Integrator Operable Unit may retain or replace portions or all of the actions conducted through this ROD. However, nothing conducted pursuant to this ROD is deemed inconsistent with likely final remedial actions.

PART 3

RESPONSIVENESS SUMMARY

3.1 Responsiveness Summary Introduction

The responsiveness summary has been prepared to meet the requirements of Sections 113(k)(2)(b)(iv) and 117 (b) of CERCLA, as amended by SARA, which requires the DOE as "lead agency" to respond "...to each of the significant comments, criticisms, and new data submitted in written or oral presentations" on the PRAP.

The DOE has gathered information on the types and extent of contamination found, evaluated remedial measures, and has recommended an interim remedial action to initiate control of the contamination found in the Northeast Plume. As part of the remedial action process, a notice of availability regarding the PRAP was published March 12 and March 13, 1995, in The Paducah Sun, a regional newspaper. The PRAP for Interim Remedial Action of the Northeast Plume was released to the public March 12, 1995. This document was made available at the Environmental Information Center in the West Kentucky Technology Park in Kevil, Kentucky, and at the Paducah Public Library. A public comment period began March 12, 1995, and continued until April 25, 1995.

Specific groups which received individual copies of the PRAP included the local PGDP Neighborhood Council, Natural Resource Trustees, and the PGDP Environmental Advisory Committee. Informal meetings were held with the PGDP Neighborhood Council April 27, 1995 and with the PGDP Environmental Advisory Committee on April 20, 1995. At these meetings, DOE personnel briefed the groups on the proposed action and solicited both written and verbal comments.

Telephone calls or visits were made to various stakeholders, including neighbors and representative of environmental groups, to alert them to the public comment period and briefly explain the PRAP. Proposed remedial action plans and/or ICMS were mailed to those contacted.

Public participation in the CERCLA process is required by SARA. Comments received from the public are considered in the selection of the remedial action for the site. The responsiveness summary serves two purposes: (1) to provide DOE with information about the community preferences and concerns regarding the remedial alternatives, and (2) to show members of the community how their comments were incorporated into the decision-making process. This document summarizes both the oral and written comments during the various informal meetings and telephone calls, and the written comments received during the public comment period running from March 12 through April 25, 1995.

As evidenced from the comments received during the public comment period, the selected interim remedy specified in the ROD for interim remedial action has received concurrence by the EPA, the KDEP and the DOE.

The Environmental Advisory Committee, a panel of local businessmen and scientists organized and supported by Martin Marietta Energy Systems, Inc., to provide feedback on environmental restoration at the PGDP, generally expressed concern that no imminent health hazard exists and that the pump and treatment method may not halt or even impede the advancement of the plume's edge.

Comments received during the public comment period for the interim remedial action are summarized below. Comments and responses have been divided into two parts and are categorized by topic within the responsiveness summary: Part I for local community concerns, and Part II for specific legal and technical questions. The comments below have been paraphrased in order to effectively summarize them in this document. Copies of the written comments are available for review at the Environmental Information Center.

3.2 Summary and Response to Local Community Concerns

COMMENT: The pump and treat facility for the Northwest Plume has not been put into operation. Thus, the data from the Northwest Plume is not yet available. The pump and treat method may or

may not halt or even impede the advancement of the plume edge. We believe that no imminent health hazard exists."

RESPONSE: Pump and treat technologies have been demonstrated to provide an effective method for containment. By addressing the high concentration areas of the plume through containment the DOE hopes to provide protection to human health and the environment, and decrease future costs associated with remedial actions. This interim remedial action will mitigate the migration of the plume while on-site sources remedies are implemented.

COMMENT: Change the present proposal to include the cooling tower treatment.

RESPONSE: The DOE will treat the extracted ground water via the cooling towers.

3.3 Comprehensive Response to Specific Legal and Technical Comments

COMMENT: Changing of the ROD to reflect removal of TCE by the use of the cooling towers as an air TCE stripper will reduced the cost and the development of such a useful, innovative technique would allow the Environmental Advisory Committee to reluctantly withdraw its objection to the pump and treat proposal. The Environmental Advisory Committee does not agree to the present proposed plan and a ROD based on its preferred alternative, and then modifying the ROD after it is signed. Any modifications should be made prior to a ROD's signing.

RESPONSE: Following a detailed review of regulatory requirements, engineering standards, PGDP operation guidelines, and comparative cost effectiveness, the DOE decided to utilize the existing cooling towers for volatilization of the TCE contained in the extracted ground water. This decision was reached through a cooperative effort of several organizations including the DOE, the EPA, the KDEP, and the USEC.

Appendix

Northeast Plume Interim Remedial Design Schedule

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